SIMPLE AUTOMATED SOURCE SWITCH

CROSS-REFERENCES TO RELATED APPLICATIONS

[0001] The subject patent application claims priority to and all the benefits of U.S. Provisional Patent Application Serial No. 60/424,272, which was filed on November 6, 2002, and U.S. Provisional Patent Application Serial No. 60/473,301, which was filed on June 23, 2003.

FIELD OF THE INVENTION

[0002] The present invention relates generally to the supply of electrical power to systems, and more particularly, to an apparatus which automatically switches between first and second power devices in response to power loss and/or restoration of power.

BACKGROUND OF THE INVENTION

[0003] Computer, telecommunication systems, medical equipment, and other electrical loads are often used in critical processes. Generally these loads are provided with electrical power through a primary power device, e.g., a power grid, electrical generator, or an uninterruptible power supply (UPS). It is known to use a secondary power device, e.g., a second UPS, to supply electrical power when the primary power device fails or is offline.

[0004] Generally, UPSs store electrical power in batteries from a supplied power source. An electronic circuit, internal to the UPS, may be used to detect the loss of the supplied power source and switch to the batteries. The electronic circuit includes electronic components, such as silicon controlled rectifiers

(SCR), triacs, capacitors, etc., which may fail. In the case of loss of the supplied power source and failure of the UPS, the critical loads will be without power.

[0005] Additionally, the UPS will need either repair, replacement and/or maintenance. During repair, replacement, and/or maintenance, the UPS may be offline and will be unable to supply power.

[0006] The present invention is aimed at one or more of the problems set forth above.

BRIEF SUMMARY OF THE INVENTION

[0007] A switching system for maintaining electrical power to a load comprises a primary power device, a secondary power device, and an automatic switch. The automatic switch includes a primary terminal electrically connected to the primary power device, a secondary terminal electrically connected to the secondary power device, and an output terminal for providing electrical power to the load. The automatic switch also includes an electromechanical relay for automatically switching the source of electrical power to the load between the primary power device and the secondary power device. The relay includes a first relay input terminal electrically connected to the primary terminal, a second relay input terminal electrically connected to the secondary terminal, and a relay output terminal electrically connected to the output terminal. The relay also includes an electromagnet electrically connected to the first relay input terminal. The relay further includes a electro-magnetically actuated multi-pole activator for electrically connecting the first relay input terminal to the relay output terminal when the electromagnet is energized and for electrically connecting the second relay input terminal to the relay output terminal when the electromagnet is not energized. A

biasing means is operatively connected to the multi-pole activator for assisting in the switching of the multi-pole activator when the electromagnet is not energized. The switching system is characterized by a coupling terminal electrically interconnecting the secondary terminal and the primary power device for transmitting electrical power from the secondary power device to the primary power device.

BRIEF DESCRIPTION OF THE DRAWINGS

[0008] Other advantages of the present invention will be readily appreciated as the same becomes better understood by reference to the following detailed description when considered in connection with the accompanying drawings wherein:

[0009] Figure 1 is a diagrammatic illustration of a switching system to supply electrical power to one or more loads from a primary power device or a secondary power device, according to an embodiment of the present invention;

[0010] Figure 2 is a diagrammatic illustration of the switching system to supply electrical power to one or more loads from a primary uninterruptible power supply (UPS) or a secondary UPS, according to a first embodiment of the present invention; and

[0011] Figure 3 is a diagrammatic illustration of the switching system to supply electrical power to one or more loads from the primary UPS or an external power source, according to a first embodiment of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

[0012] Referring to the Figures, wherein like numerals indicate like or corresponding parts throughout the several views, a switching system is shown at **10**.

The switching system **10** maintains electrical power to a load **12**. The switching system **10** includes an automatic switch **11**, a primary power device **14**, and a secondary power device **16**.

[0013] Referring to Figure 1, the primary and secondary power devices **14**, **16** may be any type of power device, including, but not limited to, an uninterruptible power supply (UPS), a generator, a power conditioner, or a utility power source.

[0014] The automatic switch **11** provides a means for automatically switching electrical power between the primary power device **14** and the secondary power device **16**. The switch **11** senses when the primary power device **14** has failed, or otherwise stops providing power, and automatically switches to the secondary power device **16**. Additionally, when the primary power device **14** is restored, the switch **10** automatically switches back to the primary power device **14**.

[0015] The automatic switch **11** includes a primary terminal **20A** electrically connected to the primary power device **14** and a secondary terminal **20B** electrically connected to the secondary power device **16**. The automatic switch **11** also includes an output terminal **20C** for providing electrical power to the load **12**.

[0016] The automatic switch **11** also includes a coupling terminal **20C** electrically interconnecting the secondary terminal **20B** and the primary power device **14**. This coupling terminal **20D** allows for routing of electrical power from the secondary power device **16** to the primary power device **14**.

[0017] In a first embodiment of the invention, as shown in Figure 2, the primary power device **14** is a primary UPS **15** for storing and supplying electrical power. The secondary power device **16** is a secondary UPS **17**, also for storing and supplying electric power. An external power source **34**, such as utility power, is

electrically connected to the secondary UPS **17** to provide electrical power to the secondary UPS **17**. The coupling terminal **20C** allows the primary UPS **15** to receive power from the secondary UPS **17**.

[0018] As previously stated, many alternate embodiments can also be contemplated by those skilled in the art. In a second embodiment, as shown in Figure 3, the primary power device **14** is the primary UPS **15** and the secondary power device **16** is the external power source **34**.

[0019] The automatic switch **11** further includes an electromechanical relay **18**. The relay **18** automatically switches the source of electrical power sent to the load **12** between the primary power device **14** and the secondary power device **16**. The relay **18** comprises a first relay input terminal **28** electrically connected to the primary terminal **20A** and a second relay input terminal **30** electrically connected to the secondary terminal **20B**. A relay output terminal **32** is electrically connected to the output terminal **20C**.

[0020] The relay further includes an electromagnet **24**. The electromagnet is electrically connected to the first relay input terminal **28**, such that the electromagnet **24** becomes energized when a sufficient amount of power is present on the first relay input terminal **28**. An electro-magnetically actuated multi-pole activator **22** electrically connects the first relay input terminal **28** to the relay output terminal **32** when the electromagnet **24** is energized. A biasing means **26** is operatively connected to the multi-pole activator **22**, so that when the electromagnet **24** is not energized, the multi-pole activator **22** makes an electrical connection between the second relay input terminal **30** and the relay output terminal **32**. In the first embodiment, the biasing means **26** is a spring **26**. In an alternate embodiment, the biasing means **24** includes a permanent magnet (not shown).

[0021] The electromagnet **24** and biasing means **26** must be adequately designed to quickly actuate the multi-pole activator **22** without disrupting electrical power to the load **12**. In one embodiment, the electromagnet **24** may be an air-core type to preclude residual magnetism, so that the critical balance between the competing electromagnet **24** and biasing means **26** is preserved.

[0022] If the primary device **14** fails or is taken offline, power is no longer supplied to the electromagnet **24**. The biasing means **26** trips the multi-pole activator **22**, thereby making an electrical connection between the second relay input terminal **30** and the relay output terminal **32**. Power is then supplied to the loads **12** via the secondary power device **16**. The transfer between power devices **14, 16** occurs without human or external intervention and does not interrupt the ongoing critical process performed by the loads **12**.

[0023] Once the primary power device **14** has been repaired or maintenance has been completed and it is back online, power is supplied to the electromagnet **24**, again closing the connection between the first relay input terminal **28** and the relay output terminal **32**. Power is again supplied to the loads **12** via the primary power device **14**.

[0024] Those skilled in the art appreciate that the output terminal **20C** may consist of several electrical connections in parallel. This allows a plurality of loads **12A, 12B, 12C, 12D, 12E** to be easily served by the switching system **10**. The several electrical connections of the output terminal **20C** may be in the form of standard outlets for accepting standard plugs.

[0025] The coupling terminal **20D** may also consist of several electrical connections in parallel. These electrical connections may also be in the form of standard outlets for accepting standard plugs. These standard outlets may be

used to provide simple automatic external maintenance power to the primary power device **14** without requiring an electrician to install another outlet or a circuit breaker. Also, the outlets of the coupling terminal **20D** may be used to provide power to a tertiary power device, such as a tertiary UPS (not shown). The tertiary UPS may be used, for example, to provide extended battery backup time to targeted protected loads (not shown).

[0026] The automatic switch **11** may also include a number of other enhancements. A first enhancement is an on-off switch (not shown) provided between the relay output terminal **32** and the output terminal **20C** to mechanically cut power output to the loads. The on-off switch may also be provided with a circuit breaker. A second enhancement is at least one indicator lights (not shown) to provide a visual indication of which power devices **14, 16** are available and/or in use. A third enhancement is additionally surge or spike suppression devices (not shown) provided with the automatic switch **11**. These suppression devices are especially useful when UPSs are not used as the primary and secondary power devices **14, 16**.

[0027] Obviously, many modifications and variations of the present invention are possible in light of the above teachings. The invention may be practice otherwise than as specifically described within the scope of the appended claims.